In the Claims

Cancel claims 1-22, 27, 30, 35 and 36, amend claim 31, and add new claims 37-40 as follows:

1-22. (cancelled)

23. (original) A method for determining alignment error in electronic substrates comprising:

providing on a layer of a substrate a first contrasting set of elements forming a first grid pattern having a distance between elements; the first grid pattern having a plurality of grid segments in at least one of the x and y directions;

providing nested within at least one of the first grid pattern segments, on the same or different layer of a substrate, a second contrasting set of elements forming a second grid pattern having a distance between elements, the second grid pattern having a plurality of grid segments in the x and y directions, the distance between the second set of elements being less than the distance between the first set of elements;

measuring location of the first set of elements in the first grid pattern;

determining the center of the first set of elements in the first grid pattern;

measuring location of the second set of elements in the second grid pattern;

determining the center of the second set of elements in the second grid pattern;

comparing the center of the first set of elements and the center of the second set of elements and determining alignment error of the first and second grid patterns.

24. (original) The method of claim 23 wherein measurement of location of the first and second sets of elements in the first and second grid patterns is by scanning with an energy beam in a line across the first and second grid patterns and determining a reflection intensity pattern that signifies location of the first and second sets of elements in the first and second grid patterns.

25. (original) The method of claim 24 wherein the determination of the centers of the first and second set of elements in the first and second grid patterns is by digitizing the location-signifying reflection intensity pattern with a predetermined pixel size, and wherein the comparison of the centers of the first and second sets of elements is calculated using pixel size of the centers of the of the first and second sets of elements.

26. (original) The method of claim 23 wherein the first grid pattern has a plurality of grid segments in both the x and y directions and including a plurality of second grid patterns, each of the second grid patterns being disposed within different segments of the first grid pattern.

27. (cancelled)

28. (original) The method of claim 23 wherein the first and second grid patterns are formed on the same lithographic layer of an electronic substrate.

29. (original) The method of claim 23 including a plurality second grid patterns formed on different lithographic layers of an electronic substrate, each of the second grid patterns being disposed within different segments of the first grid pattern.

30. (cancelled)

31. (currently amended) The method of claim ~~30~~ 38 wherein the reflected intensity pattern of the second set of elements in the second grid pattern created on the first substrate layer is aligned with the reflected intensity pattern of the second set of elements in the second grid pattern created on the second substrate layer by using the reflection intensity pattern of the first set of elements in the first grid pattern.

32. (original) The method of claim 23 wherein the grid segments formed by the first and second grid patterns comprise an array of rectilinear frames, each frame having x and y dimensions equal to the distance between elements in the first and second sets of elements.

33. (original) The method of claim 23 wherein the grid segments formed by the first and second grid patterns comprise an array of nominally square frames, each frame in the

first set of having equal x and y dimensions corresponding to the distance between elements in the first set of elements and each frame in the second set of elements having equal x and y dimensions corresponding to the distance between elements in the second set of elements.

34. (original) The method of claim 23 wherein the elements are selected from the group consisting of continuous lines, discontinuous lines, parallel lines, and aligned points.

35. (cancelled)

36. (cancelled)

37. (new) A method for determining alignment error in electronic substrates comprising:

providing on a layer of a substrate a first contrasting set of elements forming a first grid pattern having a distance between elements; the first grid pattern having a plurality of grid segments in at least one of the x and y directions;

providing nested within each of the plurality of first grid pattern segments, on the same or different layer of a substrate, a second contrasting set of elements forming a second grid pattern having a distance between elements, the second grid patterns having a plurality of grid segments in the x and y directions, each of the second grid patterns

having a different distance between the second sets of elements therein, the distance between the second set of elements being less than the distance between the first set of elements;

measuring location of the first set of elements in the first grid pattern;

determining the center of the first set of elements in the first grid pattern;

measuring location of the second set of elements in the second grid pattern;

determining the center of the second set of elements in the second grid pattern;

comparing the center of the first set of elements and the center of the second set of elements and determining alignment error of the first and second grid patterns.

38. (new) A method for determining alignment error in electronic substrates comprising:

providing on a layer of a substrate a first contrasting set of elements forming a first grid pattern having a distance between elements; the first grid pattern having a plurality of grid segments in at least one of the x and y directions;

providing nested within at least one of the first grid pattern segments, on the same layer of the substrate, a second contrasting set of elements forming a second grid pattern having a distance between elements, the second grid pattern having a plurality of grid segments in the x and y directions, the distance between the second set of elements being less than the distance between the first set of elements;

measuring location of the first set of elements in the first grid pattern by scanning with an energy beam in a line across the first grid pattern and determining a reflection

intensity pattern that signifies location of the first set of elements in the first grid pattern;

determining the center of the first set of elements in the first grid pattern;

measuring location of the second set of elements in the second grid pattern by scanning with an energy beam in a line across the second grid pattern and determining a reflection intensity pattern that signifies location of the second set of elements in the second grid pattern;

determining the center of the second set of elements in the second grid pattern;

comparing the center of the first set of elements and the center of the second set of elements and determining alignment error of the first and second grid patterns;

forming on a subsequent, second layer of the substrate another second grid pattern with second contrasting set of elements nested within a different first grid pattern segment, the first and second grids pattern on the first substrate layer being visible through the second substrate layer;

scanning with an energy beam in a line across the first and second grid patterns created on the first substrate layer and determining a reflection intensity pattern that signifies location of the first and second sets of elements therein;

scanning with an energy beam in a line across the first grid patterns on the first substrate layer and the second grid pattern created on the second substrate layer and determining a reflection intensity pattern that signifies location of the sets of elements therein;

aligning the reflected intensity pattern of the second sets of elements in the second grid pattern created on the first substrate layer and in the second grid pattern created on the second substrate layer;

using the reflected intensity patterns, determining the centers of the first and second sets of elements in the first and second grid patterns on the first and second substrate layers; and

comparing the centers of each of the second set of elements in the second grid patterns on the first and second substrate layers with the centers of the first set of elements of the first grid pattern segment in which it is nested and determining alignment error.

39. (new) A method for determining alignment error in electronic substrates comprising:

providing an optical imaging system having a light source of wavelength λ, numerical aperture NA, and a partial coherence σ;

providing on a layer of a substrate a first contrasting set of elements forming a first grid pattern having a distance between elements; the first grid pattern having a plurality of grid segments in at least one of the x and y directions;

providing nested within at least one of the first grid pattern segments, on the same or different layer of a substrate, a second contrasting set of elements forming a second grid pattern having a distance between elements corresponding to a period p defined by the expression:

$$p \geq \lambda / (NA\ (1 + \sigma))$$

the second grid pattern having a plurality of grid segments in the x and y directions, the distance between the second set of elements being less than the distance between the first set of elements

the second set of elements in the second grid pattern has period p, corresponding to the distance between the second set of elements;

measuring location of the first set of elements in the first grid pattern using the optical imaging system;

determining the center of the first set of elements in the first grid pattern;

measuring location of the second set of elements in the second grid pattern using the optical imaging system;

determining the center of the second set of elements in the second grid pattern;

comparing the center of the first set of elements and the center of the second set of elements and determining alignment error of the first and second grid patterns.

40. (new) A method for determining alignment error in electronic substrates comprising:

providing an optical imaging system having a light source of wavelength λ, numerical aperture NA, and a partial coherence σ;

providing on a layer of a substrate a first contrasting set of elements forming a first grid pattern having a distance between elements; the first grid pattern having a plurality of grid segments in at least one of the x and y directions;

providing nested within at least one of the first grid pattern segments, on the same or different layer of a substrate, a second contrasting set of elements forming a second grid pattern having a distance between elements corresponding to a period p defined by the expression:

$$p/2 < \lambda / (NA\ (1 + \sigma)) < p$$

the second grid pattern having a plurality of grid segments in the x and y directions, the distance between the second set of elements being less than the distance between the first set of elements

the second set of elements in the second grid pattern has period p, corresponding to the distance between the second set of elements;

measuring location of the first set of elements in the first grid pattern using the optical imaging system;

determining the center of the first set of elements in the first grid pattern;

measuring location of the second set of elements in the second grid pattern using the optical imaging system;

determining the center of the second set of elements in the second grid pattern;

comparing the center of the first set of elements and the center of the second set of elements and determining alignment error of the first and second grid patterns.